

## REMARKS

Claims 1-8, 11 and 13-15 are pending in the present application. By this Amendment, Applicants have amended claims 1 and 14, and cancelled claims 4 and 9. Applicants respectfully submit that the present application is in condition for allowance based on the discussion which follows.

As an initial comment, Applicants respectfully submit that this Amendment After Final is appropriate for entry, as the amendment to claim 1 includes subject matter previously recited in claim 9, which previously depended from claim 1, namely that the amount of plasticizer is at least 1% and less than 10% by weight relative to the amount of titanium zeolite employed. Accordingly, the subject matter now recited in claim 1 was previously considered and examined as previous claim 9. In addition, as will be discussed in greater detail below, subject matter basis for the specific titanium zeolite powder being a silicalite of formula  $x\text{TiO}_2(1-x)\text{SiO}_2$  in which  $x$  is from 0.0001 to 0.5 was previously considered as recited in claim 4 and is further fully supported by the specification as filed. Similar amendments were made to claim 14, which recites a related method. Accordingly, Applicants respectfully submit that not more than a cursory review will be necessary in order to examine claims 1 and 14, as currently amended. Therefore, in accordance with 37 C.F.R. § 1.116, Applicants respectfully submit that this Amendment is appropriate for entry in an Amendment After Final.

Claims 1-3, 5-7, 9, 11 and 13-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Grosch et al. (DE 19623611) (hereinafter "Grosch"), in view of Hefele et al. (WO 98/37965) (hereinafter "Hefele"), and further in view of Sepulveda et al. (U.S. Patent No. 4,613,427) (hereinafter "Sepulveda"). In maintaining the rejection in view of the aforementioned prior art references, in the Office Action's Response to Amendment and

Arguments section, it was alleged that the previously filed Declaration under 37 C.F.R. § 1.132 (hereinafter “Strebelle Dec.”) remains insufficient. As explained in the final rejection dated November 19, 2008, the Strebelle Dec. exemplifies a specific zeolite, a specific binder, a specific pore-forming agent and a specific plasticizer in specific amounts, none of which were specifically recited in combination in the claims.

Without addressing the merits of the current prior art rejections, and in order to move the case forward to allowance, by this Amendment, Applicants have amended independent claims 1 and 14 to now recite the specific titanium zeolite powder and quantity of plasticizer, in accordance with the experiments of the Strebelle Dec., and as previously recited in claims 2 and 9. As currently amended, the Strebelle Dec. fully supports the novelty and non-obviousness of the claimed invention. Subject matter basis for the amendments to claims 1 and 14 can be found in the present application as filed, including the amount of plasticizer which was previously recited in claim 9. Subject matter basis for the specific titanium zeolite powder can be found in the present specification, page 2, lines 1-4, and claims 2 and now cancelled claim 4. Accordingly, the amendments to the claims do not constitute new matter.

Applicants respectfully submit that it will be clear from comparing the Strebelle Dec. and the present claims that the present claims are directed to a method which is fully supported by the examples of the Strebelle Dec., as further summarized below.

The additional examples submitted in the Strebelle Dec. are based on the following mixture:

- titanium zeolite powder which is TS-1\*,
- 4% of plasticizer (cellulose) by weight of TS-1\*,
- 6, 11 and 20% of binder (silicone binder) by weight of TS-1\*,
- 0, 10 and 20% of pore-forming substance (melamine) by weight of TS-1\*, and
- 60% of water by weight of TS-1\*.

(\*TS-1 is a titanium zeolite of formula  $x\text{TiO}_2(1-x)\text{SiO}_2$  in which  $x$  is from 0.0001 to 0.5 [specification, page 2, lines 1-4].)

Amended claims now recite that in the mixture of step (a):

- the titanium zeolite is a silicalite of formula  $x\text{TiO}_2(1-x)\text{SiO}_2$  in which  $x$  is from 0.0001 to 0.5, thus material known by the name "TS-1,"
- the plasticizer is used in an amount from 1 to less than 10% by weight of the titanium zeolite,
- the binder is a silicon derivative binder, used in an amount of more than 5% and less than 20% by weight of the titanium zeolite,
- the pore-forming substance is used in an amount from 5 to 35% by weight of the titanium zeolite, and
- the plasticizer and the pore-forming substance are distinct from one another.

Further, although the nature of the pore-forming substance is not specifically defined in the present claims, the nature of pore-forming substances are well known in the art. Therefore, it is unnecessary to include additional details in description of these substances beyond what is described in the Strebel Dec. Support for this can be found in the Examiner cited prior art of Hefele (e.g., column 7, lines 7-12) and Sepulveda (column 4, lines 17-21), which disclose various kinds of pore-forming substances, without identifying differences regarding their properties and, therefore, the respective inventors consider them as equivalents. Accordingly, the claimed method is consistent with the examples of the Strebel Dec., and vice versa, to fully support the novelty of the claimed method.

In addition, the nature of the plasticizer is not specifically defined in the present claims, as, again, the prior art of Grosch (column 1, line 22-column 2, line 2) does not make a distinction between plasticizers, in accordance with its method in this art. Accordingly, in this art, further definition of the plasticizer is unnecessary in order to establish novelty, and in order to practice the invention as claimed. Therefore, the examples in the Strebel Dec. demonstrating properties, features and advantages over the prior art are commensurate in scope with the pending claims.

Now considering that the Strebelle Dec. is commensurate in scope with the claims, Applicants respectfully submit that the Strebelle Dec. is sufficient and does demonstrate novelty and non-obviousness of the present method over the cited prior art references. Specifically responding to the Examiner's comment in the final rejection of November 19, 2008 questioning whether the example in the Strebelle Dec. with regard to the pore-forming substance produced an unexpected result as the same rate constant (k) was obtained in the absence of the use of melamine and 6 g of binder (Ex. 1) compared to 10 g of melamine and 20 g of binder (Ex. 5), Applicants respectfully submit that it appears that the Examiner has not taken into consideration that a good compromise must be found between mechanical strength (weight loss through attrition) and catalyst activity (kinetic constant related to  $H_2O_2$ ). Furthermore, in view of the amended claims, Examples 1 and 5 are actually comparative examples. Indeed, in Ex. 1, no pore-forming substance is added and, in Ex. 5, 20% binder is added. Thus Exmaples 1 and 5 are directed outside the scope of the amended claims in that the amended claims recite more than 5% and less than 20% binder.

Moreover, Applicants respectfully submit that the present claims are novel and not in any way obvious in view of the cited prior art, individually or in combination, which will be apparent based on the following discussion of the prior art references.

Grosch discloses a process for the production of epoxides using an oxidation catalyst based on titanium silicalite zeolite powder. However, Grosh is silent about the use of a pore-forming agent, especially in an amount from 5 to 35% by weight of zeolite.

Applicants respectfully note that zeolites are, by definition, porous compounds. Indeed, as explained in Appendix A, zeolites contain regular channels or interlinked voids forming pores (Appendix A, Chapter 1, § 1 "Introduction") and their principal characteristic is the well-defined

system of regular cavities or channels (see Appendix A to these Remarks, Chapter 1, § 1, and Chapter 3.1, especially, page 3, col. 1, ¶ 2).

Furthermore, Applicants respectfully submit that Hefele does not teach or in any way describe an epoxidation catalyst or a catalyst comprising titanium zeolites, contrary to the Examiner's prior allegation. Applicants respectfully submit that the Examiner has failed to identify any portion of Hefele which discloses a titanium-based oxidation catalyst. Moreover, Hefele actually relates to coated catalysts comprising an inert-nonporous support material on which a catalytically active composition comprising titanium dioxide in an anatase modification (and vanadium pentoxide) is applied in layer form (see, e.g., Hefele, claim 1 and column 5, lines 11-16).

It must be emphasized that, contrary to the Examiner's assertion, titanium dioxide containing catalysts are completely different from titanium zeolite catalysts. Therefore, it is improper to in any way compare or equate titanium dioxide containing catalysts to titanium zeolite catalysts, especially in the field of epoxidation reactions. In fact, the titanium present in titanium zeolites of TS-1 type catalyzes epoxidation reactions, while anatase TiO<sub>2</sub> can only catalyze the H<sub>2</sub>O<sub>2</sub> decomposition, and the existence of anatase in active TS-1 samples results in decreased hydrogen peroxide efficiencies in the epoxidation reaction (see, Appendix B, page 235, column 1 and § 1 "Introduction" and Appendix C, abstract, ¶ 3).

As will be clear to one of ordinary skill in the art, and in view of the aforementioned discussion, one of ordinary skill in the art would not combine the teaching of Grosch with the teaching of Hefele, since Hefele relates to a type of oxidation catalyst which cannot be used as an epoxidation catalyst, as claimed in the present invention. Accordingly, one of ordinary skill in

the art would not have been led to combine Hefele with Grosch to arrive at the claimed invention.

Moreover, even if one of ordinary skill in the art would have combined the disclosure of Hefele with Grosch, one would not have been led to add pore-forming compounds to a product which is already porous, i.e. the epoxidation catalyst of Grosch. It must be emphasized that in order for two or more references to be combined in an obviousness-type rejection under 35 U.S.C. § 103(a), there must be some apparent reason why one of ordinary skill in the art would have been led to combine the cited prior art references. Stated differently, there must be some apparent reason why one of ordinary skill in the art would have modified the closest prior art reference, adding to it or removing from it various elements known in the art, to close the gap between the closest prior art and that of the claimed invention. *KSR Int'l v. Teleflex, Inc.*, 550 U.S. 398 (2007). For example, one reason would be if one of ordinary skill in the art had recognized a problem identified in the prior art and had knowledge of a benefit or solution achieved by modifying the prior art in order to arrive at the claimed invention. However, prior to the present invention, and in view of the prior art, one of ordinary skill in the art would not have known or had any reason to add pore-forming compounds to a product which is already porous. Therefore, it is not relevant that a titanium dioxide composition described in Hefele may comprise auxiliaries, such as pore-formers, or that it is known that porosity increases the available surface area of the catalyst, which would favor its efficiency, since Grosch already includes porous material. Therefore, one of ordinary skill in the art would not have seen a problem with the material of Grosch or recognized any benefit from modifying the material of Grosch, in view of Hefele. Furthermore, further increasing the porosity of the catalyst of Grosch would actually lead to a decrease in its resistance to attrition, which is not desirable or suitable.

Therefore, the art actually teaches away from increasing the porosity and, thus, away from the claimed method.

In addition, although the Examiner alleged that Sepulveda relates to catalysts prepared by extrusion, and thus alleges that it would have been obvious for one of ordinary skill in the art to combine its teaching with that of Grosch, which also relates to a catalyst prepared by extrusion, Applicants respectfully submit that, based on a complete understanding of Sepulveda, one of ordinary skill in the art would not have combined its catalyst with the method disclosed in Grosch. Sepulveda relates to the preparation of catalysts based on clay, which is a non-porous compound, and thus teaches the addition of a pore-forming substance to the composition. As for Hefele, one of ordinary skill in the art would not take the teaching of Sepulveda into account to improve the properties of the epoxidation catalyst of Grosch, as the catalyst of Grosch is, by definition, already porous and there is no motivation or teaching to lead one to further increase its porosity. Furthermore, increasing the porosity of the catalyst of Grosch would *a priori* lead to a decrease of its resistance to attrition.

In conclusion, as discussed above, and provided in the Strebelle Dec., Applicants have surprisingly found that adding a pore-forming agent in an amount of 5 to 35% titanium zeolite catalysts (which is, by definition, already porous), prepared by extrusion, improves the catalyst activity (e.g., increased kinetic constant related to  $H_2O_2$ ), while the mechanical strength of the catalyst (weight loss through attrition) is not impacted or even improved, provided that a silicon derivative binder is added in an amount of more than 5 and less than 20% by weight of the titanium zeolite. Nothing in Grosch, Hefele or Sepulveda, individually or in combination, teach one of ordinary skill in the art that it is usual to or that one should increase the porosity of a zeolite catalyst which is, by definition, already porous. Furthermore, nothing in the

aforementioned cited references teach one of ordinary skill in the art that a good compromise must be found between mechanical strength and catalytic activity, where the compromise is linked to the respective amounts of binder and pore-forming substance.

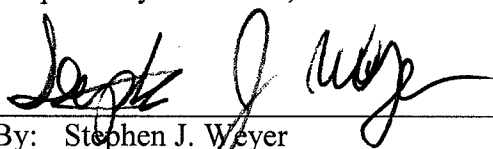
Based on the foregoing, Applicants respectfully submit that claims 1-3, 5-7, 11 and 13-15 are not obvious in view of the cited prior art.

Claims 4 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Grosch, Hefele and Sepulveda, further in view of U.S. Patent No. 5,965,476 (hereinafter "Balducci"). Applicants respectfully submit that, as discussed above with regard to the rejection of the claims in view of Grosch, Hefele and Sepulveda, the aforementioned references fail to teach or in any way make obvious the subject matter of claims 4 and 8. Further, Applicants respectfully submit that the additional cited reference of Balducci fails to teach or in any way make up the deficiencies of the aforementioned prior art references with regard to the subject matter of claims 4 and 8. Accordingly, Applicants respectfully request that the rejection to claims 4 and 8 be withdrawn.

In view of the foregoing, Applicants respectfully submit that the present application is in condition for allowance.

Respectfully submitted,

Date: June 1, 2010

  
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